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ESSAYS ON

Practical Poultry Keeping

IN CALIFORNIA

Reprinted from articles published in the Los Angeles Times Illustrated Weekly, with additions and plans of poultry buildings

By

MAJOR C. DEVONSHIRE

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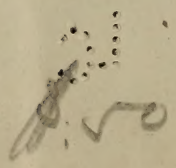
PREFACE

These essays, with the exception of the last two, and the drawings were published as a series of articles in the Poultry Section of the Los Angeles Times Illustrated Weekly, by the authorization and consent of Gen. Harrison Gray Otis, Editor in Chief, to whom the best thanks of the author are due. The very kind reception given to them by the public, as evidenced by the large number of letters of congratulation and inquiry received by the writer from all parts of the Western States, has encouraged him to put them into pamphlet form. These essays aim to be a slight contribution towards the standardization of the methods of raising poultry in California. The writer has long felt that many are deterred from entering the poultry business owing to the multiplicity and elaborate character of methods recommended to them. The general acceptance of certain simple and, as far as is consistent with efficiency, economical methods—economical that is both of money and labor—would seem to be urgently needed. The writer has been engaged for many years in the attempt to ascertain the root principles underlying all poultry raising and to endeavor by exhaustive experimental work, to lay the foundation of a standardization of methods, i.e., of methods which would become generally recognized as well calculated to produce financially good—if not indeed, the best results.

His general conclusions are submitted in this pamphlet.



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CHAPTER I.

["Memorandum upon investigations" as to the mineral ash in average soils and foodstuffs available for stock and poultry, carried out in South Africa, Great Britain, Canada and California, during the years 1903-1913, inclusive, by the author.]

MY attention was first drawn to this subject in 1903-5 in connection with my investigation into a disease of poultry in South Africa commonly known as the "poultry sickness" or "the sickness." This disease was common to all the states of the South African Union, and its ravages were so severe that no poultry industry existed in South Africa, as capital could not be obtained for the business.

The peculiarity of the disease was that no symptoms either before or after death could be detected. Birds apparently well over night were found dead under the perches in the morning, and whole flocks were frequently decimated within a week following the appearance of the disease.

The writer visited a large number of farms where a few fowls ran at liberty around the barns, this being the extent to which poultry keeping was followed on the vast majority of farms in the Union. Cure was impossible, and the steps taken to prevent the disease were the subject of my inquiries. In every case I found that where the disease had been more or less warded off, mineral matter, such as epsom salts, soda, lime and certain bitter herbs, presumably rich in some mineral salt, had been used.

Recourse to books upon the composition of soils and foodstuffs showed that mineral matter ("mineral ash" or "earth salts") was always present. Further, that this "mineral ash" was essential to maintain the processes of life—that it may aptly be compared to the few drops of oil without which the machinery clogs or stops altogether. Thus without a sufficiency of "ash," the gastric juice will not form, nor can the secretions of the bile, liver and intestines be maintained; the blood is largely composed of "mineral ash," also the feathers and hides of birds and live stock respectively.

I came to the conclusion that the "ash" available to birds and farm stock was deficient in the soils and foodstuffs of South Africa, and that it would be necessary to artificially manufacture the "ash" and add it to the foodstuffs.

In May, 1905, I submitted an article upon the "Feeding of Poultry" to the Director of Agriculture, Orange River Colony (now the Free State,) in which I stated that the great majority of diseases among poultry were due to a deficiency of mineral ash, available to the birds in the soils and foodstuffs. This article was published by order of the Director of Agriculture in the official organ of the government, The Farmers' Advocate, in the June issue, 1905. Eight years' work to test the truth of this proposition have verified it beyond the shadow of a doubt.

Not being a chemist myself, and there being no chemist attached to the Agricultural Department of the colony, I was unable to get a formula which would represent the missing ash. In the following August, however, I saw a formula published in the July issue of the Reliable Poultry Journal, which reached South Africa about six weeks after publication in the United States.

If I remember aright, this formula not only professed to give the mineral ash constituents, but also included some vegetable substances found in foodstuffs. It was a very expensive and elaborate formula. After sending to Europe for some of the ingredients, the druggist eventually supplied me with the powders. Their effect upon the poultry was immediate, and established beyond question that the so-called poultry sickness was simply starvation of the life processes through a deficiency of "ash." Given the use of the artificial ash, no case of poultry sickness ever occurred again.

In the following December, Prof. Juritz, one of the chemists of the Agricultural Department, Cape of Good Hope, wrote an article in the Journal of the Agricultural Department of that colony entitled "The Need for Chemical Research in the Cape Colony," in which, referring to the results of the chemical survey of the soils of Cape Colony to date, he stated that he had reported to the government that he found the soils deficient in mineral ash available for plant nutrition, that the plants were therefore deficient, and "that the animals grazing thereon must, in the long run, be seriously affected."

In the middle of 1906 I was able to go to the Transvaal, and immediately submitted my work to Prof. Ingle, chief of the chemistry division, Agricultural Department, Transvaal.

This gentleman frankly admitted that my theory was entirely new to him, and in 1909, after we had both returned to England, he again acknowledged the theory as having originated with me, in a private letter written to me in that year.

I asked Prof. Ingle to investigate my view that the low feeding value of Transvaal-grown oats for horses (which was universally acknowledged to be the case) was due to a deficiency of ash in the oats.

Analysis of these oats by him established the truth of my view. (See article, "The Mineral Ash in the Foodstuffs," by Prof. Ingle, Journal of the Agricultural Department, Transvaal, April issue, 1907.) As far as I am aware, I was the first to demonstrate that, contrary to the universally received opinion, the feeding value of a foodstuff may depend almost entirely upon the amount and composition of the ash found in it, rather than upon the proteids, fats, etc.

Further, it is a remarkable fact that

horses, whether imported or not, in South Africa, will eagerly devour locusts whenever they can get them. This abnormal appetite for animal food in herbivorous animals had never been explained. I asked Prof. Ingle to analyze the locust, as I believed that it would be found to be abnormally rich in ash, and that the craving of the horse for mineral matter led to his partiality for the locust.

This theory proved to be true. The locust's body was found to be abnormally rich in ash, especially lime. (See his article, Journal, Transvaal Agricultural Department, July, 1907.)

The contention, therefore, that "the mineral ash is always abundant and generally in excess in the foodstuffs" must be abandoned, as of universal application, although it may be true in rare instances, where plants are grown in soils abnormally rich in ash.

(As to the extreme variability of the ash content, both as regards composition and amount even in grains of the same species, see Prof. Jordan's "The Feeding of Animals" in his chapter on the subject.)

It is frequently forgotten that no farm animal draws the whole of its supply of ash exclusively from the foodstuffs, and that no foodstuffs, however rich in ash, could furnish the amount required, since farm animals and poultry draw a large proportion of the ash direct from the soil.

In South Africa, before the country was fenced, stock would travel for many miles to lick deposits of mineral matter found in isolated spots.

It is a common thing to see horses, on being let out from the barn, eating earth. This indicates a craving for mineral matter, which is satisfied by adding the artificial ash to the animal's ration, when it will not again have recourse to eating earth.

The "deer lick" is familiar in California as indicating some spot frequented by deer where they can lick some deposit of mineral matter found there.

A well-known California cattleman recently asked the writer: "What do my cattle on free range in the mountains find there which they do not get when kept in the barn? My cattle in the mountains rarely abort, while those in the barn are often sick and frequently abort."

The explanation is that without abundant mineral matter the cow cannot construct the framework of the foetus in the womb, since the supply of ash available to her in the barn is insufficient, oftentimes, for her own needs, let alone those of the growing foetus. In other words, the food given in the barn cannot furnish a sufficiency of ash, however rich that food may be in ash. It is, however probably true to say that the majority of foods are deficient, rather than otherwise, in ash, as the bulk of the soils in which they are grown are almost certainly deficient in ash. The cow in the mountains supplements the supply in the foodstuffs by licking the deposits of ash which she finds in the soils.

As regards poultry, the foregoing is also true, in that they depend for the bulk of their supply of "ash" upon the grit which they can pick up.

It is certain that fowls eat grit, not merely for the mechanical action set up by grit in the gizzard, but mainly for the mineral ash contained in the grit. This grit is dissolved by the acid of the gastric juice and the particular "salt" contained in the grit is thereby liberated and assimilated by the bird like any other food constituent. The artificial ash is therefore assimilated by the fowl as a food constituent and not as a medicine.

The following facts would seem to establish conclusively the truth of the contention of the previous paragraph:

Birds were found by the writer on part of a farm where the poultry sickness was unknown. Two miles away, on the same farm, birds were dying rapidly of the sickness.

Examination of the range of the healthy birds showed a deposit of gravel rich in ash. It was also shown that the birds frequented this deposit. A wagon load of this gravel was taken over to the sick birds, which eagerly devoured it, and the sickness disappeared in a few days.

The conclusion is irresistible that the mineral matter in the grit must have been dissolved in the gizzard and assimilated by the bird like other food constituents. One enormously important deduction is that it furnishes the explanation of the well-known fact that birds confined in runs, or ranging over the same ground for a long period of time, will deteriorate (and that that deterioration becomes more and more rapid the longer the birds are kept in the same run.) The birds exhaust the supply of mineral grit available on the surface of the run. Anaemia immediately follows, and the power of the bird to resist disease is weakened, the germicides in the blood are enfeebled, and any of the following diseases may ensue: Leg weakness, diarrhoea, roup, catarrh, diphtheria, poor egg yields and infertile eggs, weakling chicks, etc.

Where the vitality is maintained by an abundant supply of ash, these diseases are unknown, except in isolated cases where the bird has a poor constitution, or where there is gross mismanagement of the stock.

The connection between deterioration in confinement and exhaustion of surface grit was established by the experiments made for me by Prof. Brown. (See Journal, Board of Agriculture, Great Britain, November, 1909.)

It is probably true to say that it is impossible to maintain a flock in confinement over a period of years without artificially

adding the mineral ash to the ration, except in the rare cases where the supply of ash is renewed by nature, e. g., in the case of a stream bringing down fresh supplies of grit when in flood.

If grit rich in ash is procurable, which is very rarely the case, this constitutes an artificial addition of the ash to the ration.

I omitted to mention that Prof. Ingle thought that he could construct a simple and inexpensive formula. He did so, and, after modification by me, remarkable results have invariably been obtained.

We can now sum up the position as defined by the "experts."

They tell us (1) that the mineral ash is vitally important to the birds; (2) that the ash content of grains varies enormously, i. e., that the supply of mineral ash in the foodstuffs is variable and precarious; (3) that the supply is always abundant and generally in excess; (4) that in spite of this, we must always add salt and lime to the ration and furnish abundant supplies of grit.

We then have paragraph 3 contradicting paragraph 2 and paragraph 4 contradicting paragraph 3. Thus (2) the supply of ash is precarious, but (3) it is always abundant; and, on the other hand, (4) you must artificially supply the salts, e. g., salt, lime and grit, which are, according to paragraph 3 always abundant and generally in excess. We leave the experts to fight it out.

My general conclusions are that our methods of feeding require modification.

To illustrate this contention, let us suppose that our birds are running down. We rush to the rescue with costly and indigestible mashes. The egg yield may be preserved for a time, but the eggs will not hatch or only produce a small percentage of weakly chicks. The digestive organs of the breeding stock are ruined and with them the nervous system is deranged. This derangement is shown in the morbid disease of the offspring known as toe picking.

The trouble really is that the materials for the gastric juice and the vital processes of the breeding stock are deficient, owing to a lack of ash, and instead of increasing the flow of the gastric juice by increasing the supply of ash, we ply the unfortunate birds with richer rations, although they cannot digest even the simplest rations with the diminished gastric juice available.

The machinery of the bird's body is so perfect that it will convert any ration which contains the necessary proteids and fats into eggs, provided that the wheels of the machinery are oiled. This can only be done by the mineral ash, which is thus seen to be the most vital factor in the problem of feeding poultry.

The despised and neglected ash, which is dismissed in a paragraph in most poultry books, is now found to be the elixir vitae the only source of nourishment to the vital processes—the only oil which will grease the wheels of life, of the machinery of the body. If the machinery clogs or stops, it is useless to fill the furnaces with fuel. I have seen hundreds of birds with full crops dying of starvation because there was a total stoppage of the flow of the gastric juice. The digestive organs had gone on strike and the food remained passive in the crop. A large dose of mineral ash has frequently started the machine again in a few hours, and the bird was none the worse.

After seeing thousands of birds, I am of the opinion that very few of them were not suffering more or less from a deficiency of ash available to them. After breeding thousands of birds, I am satisfied that where abundance of ash is provided, with a simple and varied ration far more remarkable results follow than have ever been produced from debilitated birds which are forced with rich rations.

Prof. Ingle once observed to me that the addition of the artificial ash to the ration was the greatest advance made in animal nutrition in his lifetime.

CHAPTER 2.

THE FEEDING OF HENS.

There are of course as many ways of feeding chickens as there are foodstuffs suitable for them, plus the countless ways in which these may be combined. The following methods are offered, as the result of eight years' use, under many conditions of climate from tropical heat to zero weather. Good paying results have always been obtained by me from their use, and while I fully recognize that improvement is always our goal, I venture to believe that these methods have yielded results sufficiently satisfactory to warrant their use, failing any better method known to individual poultrymen.

The question of exercise for the fowls is so intimately bound up with the value to the bird of the food given that it is impossible to discuss the one without the other. I am convinced that the following may be accepted as a fundamental truth: "The hotter the climate, the greater the exercise required by the hen in confinement." In the tropics I had to increase the depth of the scratching litter to eight inches to counteract the tendency of the heavy breeds to lay on too much fat. I am of opinion, after two years' work with hens in California, that the scratching shed is the most important factor, outside feeding, in success with poultry in this State. I will even go so far as to say that, feed how you will, if there is no scratching litter provided, vigorous hens and large egg yields are impossible. By egg yields I mean strongly-fertilized eggs.

It was once remarked that market eggs are of three kinds: "the new-laid," "the fresh," and "THE egg." Hens in poor con-

dition and not provided with scratching litter will produce what from the hatching point of view, is "the egg." The amount of grain thrown into the litter will regulate the amount of exercise enforced upon the hungry hens. The same result may be obtained by increasing or otherwise the depth of the litter. The grain should be thrown into the litter and the latter then turned over with a fork. This is hard work where the scratching shed is a large one, but it pays. There should always be grain in the litter (left from overnight) in the early morning. The birds come off the perches more or less stiff and cold, and it is impossible to overestimate the value to the egg yield if the birds can go straight into the litter, where they know that their labor will be rewarded with grain. Circulation of the blood and a healthy appetite are insured so that they will do justice to the mash at 8 a.m.

After breakfast the birds should be seen cleaning their feathers or lying about asleep in the shade, followed in the case of self-respecting hens by the production of an egg before 3 o'clock. As the sun goes down, the birds will start work in the litter again, the grain having been replenished about 3:30 by the poultryman. The birds will scratch away until roosting time, when about one-third of the total grain fed should be thrown on the open ground so that full crops will be insured to the flock, in case their labors in the litter should not have produced that result.

Too much exercise is as bad in its effect upon the egg yield as too little. If too much work is enforced, surplus energy intended for egg production will be consumed in the effort of scratching. The proportion of the total grain fed in the litter to that fed on the ground must be determined by observation and the judgment of the poultryman, but I think that from one-third to one-half of the grain should be fed on the ground, the amount being increased or otherwise according as the evenings are cold or the reverse.

As to the composition of the mash, I have used for eight years two parts by weight delete bran and one part by weight corn meal. This gives a ratio of about one part of protein to five of fat and carbohydrates. There is a strong prejudice against corn as a food for chickens. It is alleged that there is difficulty in obtaining sound corn. This evil can be remedied, and is no argument against corn as such.

It must be remembered that fowls require a certain amount of fat in their ration. Fat and the fatty substances are the fuel which is consumed in the body and furnishes energy. The effort of scratching consumes so much fuel or fat. Corn is rich in fat and carbohydrates, and corn is the most easily digested of all grains, i. e., practically the whole grain is digested. Speaking from memory, only about 70 per cent. of brain is digested, the other 30 per cent. passing through the body, whereas about 98 per cent. of the corn is digested. The crude protein in corn is more digestible than that of wheat, so that though the latter amounts to 15 per cent. of the dry matter, and the former to only 10 per cent. (more or less,) it is questionable whether the feeding value of the protein of corn is not as great as that of wheat.

Again, the feeding of materials deficient in fat with the idea of depriving the bird of fatty matter defeats itself, since the bird will make the surplus protein in the ration do duty for fat. This probably places unnecessary strain upon the digestive organs, and as foods rich in proteids are generally more expensive than those which are rich in fat, there is false economy in forcing the hen to use the proteids to do duty for fat.

It is contended that corn is very heating. This implies that the fat of corn contains some specially heating matter, but is this true? Does fat vary in its composition? Is not fat always fat, whether found in corn or elsewhere? It is a question for the chemists. Assuming that there is some distinctive quality of a heating nature in corn, can we not balance or counteract it with some other food? Bran is rich in certain salts which make it cooling to the blood and slightly laxative in its effects. If therefore we mix bran with the corn meal, we should produce an ideal ration, and such I have found it.

The truth seems to be that the corn is not to blame, but the trouble seems to lie in the lack of vitality so common in our hens, and the absence of scratching litter in so many yards. Feed corn to debilitated hens without means of exercise and the results will be disastrous.

Letters are reaching me daily which clearly show how widespread is debility or lack of vitality in our flocks and how fully their owners realize that this is the cause and root of all our troubles with poultry.

A healthy lad will eat food of every description, beginning with the tough beefsteak at 8 o'clock in the morning, followed by a raid upon the larder about 11 as an appetizer for a heavy luncheon at 1 p.m., etc., and all this relieved at intervals by recourse to the candy box. He eats all the candy sometimes, and not only survives, but flourishes exceedingly. Surely the explanation is that he has abounding vitality. My experience with poultry is that if abounding vitality is secured, any surplus food at all suitable will be converted into eggs. This again involves the consumption of more fatty foods, like that of the candy by the healthy boy, since the more energy is expended, the more fuel will be required, and this is furnished by the fat.

I feed a different grain every day—oats, barley, wheat and corn in succession. Given abounding vitality, the greater the

variety of grain fed the better. In this connection, note the varied ration of the healthy boy.

If hens are debilitated, meat scrap must be fed cautiously, since I have seen morbid craving for animal food set up in such birds. If vitality is abounding, I put beef scrap before the birds all the time, as they do not consume it to excess. The amount of animal life, such as grasshoppers, etc., available to the bird, it is difficult, if not impossible, to calculate, and if this animal life is available, the beef scrap will be passed by.

Morbid cravings for any particular food, and morbid tendencies such as toe picking in chickens are always a sign of some constituent being lacking in the food of the breeding stock.

CHAPTER 3.

NOTES ON THE RAISING OF CHICKENS.

PRELIMINARY CONSIDERATIONS.

A QUESTION preliminary to the consideration of this subject is: "What is the proper time to hatch chickens?" The vast majority of those who keep poultry want their spring-hatched pullets to start laying from the 1st to the 15th of October, or by the beginning of November at the latest. The "proper" time is here assumed to mean the date at which chickens must be hatched so that they will be fully matured and beginning to lay during October.

Experience all over the world establishes the rule that light breeds require five and a half to six months and heavy breeds six and a half to seven months, as a general average period, in which to reach maturity.

It might therefore be supposed that if we hatch our chicks of the light breeds on the 1st of April they will come into lay on October 1, and chicks of the heavy breeds hatched on April 1 will begin to lay on October 15 to November 1.

This is my own view, and I believe that the best time to hatch chicks in California is from April 1 to May 1 for fall laying.

This opinion is not shared by everyone. I am often told that chicks must be hatched early, and many people believe that February and March are the proper months to hatch. Some even go so far as to assert that these months are the natural breeding season.

I believe that this opinion has arisen from two main causes, of which the first is the observed fact that if young chicks do not reach a certain (undefined) stage of growth before the hot weather sets in, they will remain in a stunted condition all the summer, only resuming growth in the fall and not coming into lay until the following spring. The second cause is that where chicks are artificially hatched, it is found difficult to operate the incubators in April and May, owing to the heat of the weather.

With regard to the first, I will show that the heat of summer has nothing to do with the failure of the chickens to grow, and that the second cause is due to mechanical defects in the construction of the incubator-house.

Before dealing with these questions, let us pause a moment to ask what month does the hen for the most part select in which to raise her chicks? I am confident that if a man has 100 heavy hens, he will find that 30 per cent. of them will want to hatch their chicks about the third week in April and 40 per cent. more of them will go broody early in May. I have been forced to this conclusion by the actual facts presented to me in California by a flock of 100 farmyard hens under my care last year during the spring months.

In Northern California, above Sacramento, April 15 is the date after which no frost has ever been known; the nights are then getting warmer, the grasses and animal life are abundant. Surely this is the period which the hen would select, if left to herself, at which to go broody, so that her offspring would get the benefit of the abundant natural food supplies then available. I have also observed that chickens hatched at this time will grow much faster and suffer much less from disease and mortality than early-hatched chicks. The great variation in temperature between midday and midnight is then much diminished owing to the warmer nights.

To return to the question of the effects of summer heat upon young chicks, I am satisfied that so far from being injurious to them, it is beneficial. My convictions are largely the result of experience in the tropics. The widespread opinion to the contrary is due to a failure to perceive the true cause of the stunted condition of the chicks in hot weather. I had the good fortune to have an opportuity of testing, under the most exacting conditions, the real truth about this matter. It is hardly too much to say that if the contention that heat in Southern California stunts the growth of chicks is true, the poultry industry in this district will never assume the dimensions of a great industry. If we are forced to keep chicks eight or nine months before they will begin to lay—i. e., if we must hatch in February to get fall layers, the extra feed bill for two months will put us out of business against the man who can get his pullets to start laying at six months old. And generally, if we have no guarantee that the growth of our pullets may not be arrested at any time by a heat wave, the business of raising chicks becomes too precarious to tempt the majority.

The test made by me was carried out under the following conditions: Last July 15 I took charge of 150 pullets which had

been hatched on April 1, and which were accordingly three and a half months old. These birds were the most stunted, miserable looking lot that I ever saw. The average weight per bird was but little over one pound and they looked like poorly-managed six-weeks-old chicks. I was told that the heat had overtaken them before the mysterious stage of growth had been reached, after which their progress toward maturity would not be injuriously affected by the hot weather. I had little hope myself of being able to do anything with this stunted flock, and advised that if they could not be matured by the middle of October, so that the majority would be laying by the 1st of November, it would be better to destroy them, as it would not pay to keep them until the spring, or for nine or ten months, without any return from them in eggs. The heat during July and August last was exceptionally great, and on the theory that chicks will not grow in the heat, the conditions were as adverse as it is possible to imagine. I knew that the failure of the chicks to grow all over California was due not to the heat, but to a deficiency of mineral matter in their ration. In this case, however, I believed that that deficiency had been of such long duration—to wit, three and a half months—that the stunted condition of the chicks was, in the case of many of them, not remediable, and that only a percentage —probably not a large percentage of them —would recover. But we live and learn in the chicken business, and to my amazement, after increasing the mineral ash to equal about 5 per cent. of the mash daily, the chicks started not merely to grow, but to shoot up like mushrooms in the night. Still more surprising, only three chickens failed to respond, and by the 1st of October I had a flock of well-grown, large-boned pullets, well up to weight, and starting in to lay well. Although I had long been satisfied that "the heat injurious to chickens" theory would not hold water for one moment, this experiment, so unexpectedly forced upon me, was extremely valuable. Here we had three-and-a-half-months-old chicks, with the heat rising over 100 degrees in the shade daily, for days together.

No more favorable conditions to prove the falsity of the statement that chicks will not grow in the heat could have been secured.

I consider that this experiment is one of the most important ever carried out by me, and one of which the effects will be of far-reaching, if not, indeed, decisive importance in determining whether a great poultry industry in California is possible; in other words, whether the few fowls in the back gardens of thousands of wage-earners can be depended upon to thrive and reproduce themselves, given any reasonable care and fair treatment.

I have said that the difficulty of hatching eggs in incubators, after the hot weather has begun, is a mechanical difficulty merely. In a subsequent article I hope to show that an incubator-house can be cheaply built which will entirely overcome this objection.

I have not referred to the obvious and frequently experienced danger that chickens hatched in February will begin laying in July or August, lay a few eggs, and then go into the molt with the old hens. Such pullets will probably not resume egg production until January, and will involve heavy financial loss.

Having disposed of the "heat-injurious-to-chick-growth" theory, and the "too-hot-to-operate-the-incubator" theory as justifying February hatching, we can now fix our hatching date, in agreement with the known experience of all other countries—i. e., for light breeds, six months before egg production is required to begin, and for the heavy breeds seven months before.

One other question remains to be considered before we have settled our preliminaries, and that is, "Are incubator-bred chicks as good as hen-hatched chicks?" The consensus of opinion of experts seems to be that very few men can operate an incubator with sufficient skill to produce a chick which is APPARENTLY as good as a hen-hatched chick; in other words, that for the bulk of poultrymen their incubator chicks will not be as good as is necessary. Again, even where the greatest skill is available to operate the machines, there seems to be a slight falling-off in the artificially-hatched chicks after two or three generations of them have been artificially hatched. Where a poultryman wishes to create a strain of birds, and must hatch his own breeding stock, it would seem advisable to hatch a proportion of the breeding stock, at least, every year under hens.

CHAPTER IV.

NATURAL INCUBATION.

In my last chapter I urged that chicks of all breeds should be hatched from April 1 to May 1. The problem of how to hatch them has now to be considered. The poultryman who keeps a few hens in the back garden, to supply the needs of his household in the matter of eggs merely, will probably be well advised not to hatch any chicks at all, but to purchase well-grown pullets early in each fall to replace the old hens which should be sold off as soon as they finish laying, prior to going into the molt, in September. There are many poultry-keepers, however, who keep a few fowls not merely for profit, but for the pleasure of doing so, and the raising of chicks from their pet hens forms a large part of the interest attaching to the hobby. Again, such poultry-keepers may have choice birds

of some particular strain, which can only be perpetuated yearly by raising chicks from them.

It will be perhaps convenient to consider the best way to hatch chicks under hens first, as the owner of a few hens will generally hatch his chicks by the natural method. I should like first, however, to point out that the idea that if a hen is given free range and allowed to "steal her nest," as it is called, better results will always follow in the number and quality of the chickens hatched, is not always nor perhaps even generally true. My own experience is that a hen is seldom able to "steal a nest" without other hens discovering it and laying their eggs there as well. The result is that twenty or more eggs accumulate in the nest before the original hen goes broody and begins to sit. She tries to cover all the eggs, with the result that all are insufficiently warmed and the hatch is a total failure. Again other hens will continue to lay there, and the evil will be still further aggravated. Last year the hatches of ten of my hens which had stolen their nests in this way were total failures from the causes referred to. Where a hen does succeed in stealing a nest, which is not discovered by other hens, and after laying a clutch of twelve or fifteen eggs, goes broody and sits on them, it might be thought that, if undisturbed, the best results would reward her. In California, however, this does not by any means always follow. Under normal conditions there is sufficient moisture in the ground to enable the hen to hatch the eggs. The heat of her body draws the moisture in the ground to the surface and the eggs will not "dry down." In times of drought, however, it frequently happens that there is no moisture in the ground, and the chicks cannot get out of the shell, owing to the drying-down of the enclosing membrane, and the hatch is a failure. The weather is then denounced as being a "bad year for hatching." The remedy is very simple. In all such cases, or where the hen is set in some spot selected by the poultryman, water should be poured liberally round the nest two or three times during the hatch. If the ground round the nest is thoroughly wetted, the heat of the hen's body will draw the moisture and the eggs get the required amount. Water should never be poured into the nest, nor the eggs sprinkled or wetted by direct contact with water. The air passing over the eggs, charged with moisture evaporated by the heat of the hen's body is the natural and therefore the proper method by which the eggs should be moistened. There seems little doubt that the principal cause of the failure to get good hatches where hens are set by the poultryman is due, in California, to a failure to supply sufficient moisture to prevent the drying-down of the eggs under the hen.

We may now consider the actual procedure to be followed when a hen goes broody. Let us suppose that it is decided not to set her in the fowl-house, where she has become broody, but to remove her to a special pen where she will not be disturbed by the other hens. If a coop is selected as the place in which to set her, it is important that this should be in a shady spot, either naturally shaded by trees or shrubs, etc., or artificially by a shed overhead. If the poultry-house is cool and comfortable and the hen is transferred to a coop exposed to the heat of the sun, she will not appreciate the change and may refuse to sit in her new quarters. Again, she should have as much room as possible to move about in when she leaves the nest. If we watch a hen sitting at liberty in the open we shall observe that on coming off the nest, the biddy will emit a kind of shrieking noise, flap her wings and run for a considerable distance before she starts to look for food. Apparently the object of this behavior is to restore the circulation and get rid of the cramp which long hours on the nest have caused. The cry is apparently caused by the pain of the cramp in her legs.

Many of the failures of hens to sit throughout the hatch without deserting are undoubtedly due to the fact that the bird is so closely confined that she cannot "stretch her legs," and becomes sick, diarrhoea being the usual form of the trouble. If the sitting coop is placed in a long narrow run (the longer the better,) the greater will be the comfort of the hen. I think a run sixty feet long is the most ideal arrangement, but in many cases, of course, this cannot be given owing to lack of space. A convenient form of coop is one where the front is closed permanently except for a board twelve inches wide which slides out. The bottom of this board is four inches from the bottom of the nest, and rests on a strip that width, nailed at the bottom of the front of the box to hold in the nesting material. A two-inch-wide space should be left at the top of the front of the box for ventilation when the slide is closed. The hen should be set in the box on one or two eggs and the slide closed. She will then be in semi-darkness and may be left undisturbed for twenty-four hours. If she is then let out and can help herself to food and water set for her in the run, she will probably go back to the nest of her own accord and the slide can be left permanently open. If she goes back and settles down all right, the nest eggs may be removed at night and replaced with the eggs to be hatched. There should be no bottom to the box, which should rest on the ground.

It is a good plan to shape a shallow hollow in the earth and then thoroughly wet the ground so that as it dries the hollow will set hard. A few wisps of hay may be put around the nest and in the hollow. The

hen should be thoroughly dusted with lice powder before being set. Take hold of her by the legs and put her on her back with the legs in the air and dust her all over the breast and between the legs. Put a little lice powder in the bottom of the nest. Water and cracked corn should be placed in the run and a box full of loose earth, as a dust bath. The hen should be allowed to come off when she likes, and the less she is interfered with the better. As I have said above, do not forget to keep the ground round the nest wet in dry weather. A wetting about the eighth and sixteenth days will be sufficient, probably. Where hens are set off the ground, the bottom of the box should be filled with earth, so that the wetting process can be repeated as on the ground. The earth in front of the nest box when this is placed on the ground should be leveled up to the top of the four-inch strip at the bottom of the front of the box, so that the chicks can get back into the nest. A dozen or more hens can be set in the same run. A little care will be necessary when a hen is first set, to see that she goes back to her own nest.

It is stated that if the nest boxes be painted different colors or otherwise distinguished, the hen will recognize her own nest by these marks. I have never verified this, but it is stated to be a fact on good authority, and there is nothing improbable in it, as unquestionably hens do very quickly recognize their own nests.

Where a considerable number of hens have to be set, it is a good plan to divide by a wire partition the poultry-house into two parts, all of which are exactly alike as regards the arrangements of the nests, etc. When a hen goes broody in that part of the house reserved for the layers, she is simply put through the wire into the other part of the house. A setting of eggs is put ready for her in an unoccupied nest. As a rule, if she is transferred toward evening she will at once inspect the nest boxes which are identical in appearance with those she has left, and on seeing a comfortable nest with a clutch of eggs all ready, she will as a rule promptly annex them and settle down upon them with many murmurs of contentment. Except to see that for the first day or so she does not go back to the wrong nest, if other hens come off at the same time as herself to feed, she should be left alone until she has hatched her chicks, except when water is put round her nest on the eighth and sixteenth days, when she may be dusted at the same time with lice powder. With food and water always before her and a good run to stretch herself in, she will hatch with as much success as if she had stolen her nest and sat there under the most favorable conditions.

CHAPTER V.

ARTIFICIAL HATCHING OF CHICKENS.

The hatching of chicks by artificial means will always possess a great attraction for many lovers of poultry, and the writer is of the number of those who find that a big hatch, say 90 per cent. of the fertile eggs, affords a great deal of satisfaction. The problem is how to do it. The conditions of a problem must be, of course, known, if we wish to find a satisfactory solution.

There is a tendency, I think, to assume that the eggs will hatch if the incubator is properly managed. If the latter is the case, and the hatch is a failure, we are apt to blame the incubator. I believe that the incubator is seldom the principal cause of the failure, if it is managed with anything like ordinary care. The main causes of failure would seem to lie, first, in the condition of the breeding stock, and second, in the location of the incubator. In a previous article, I gave expression to my strong belief, confirmed more and more as experience is gained, that where birds are kept in confinement, in Southern California, strongly fertilized eggs, i. e., eggs of high hatching value, cannot be obtained year in and year out, generation after generation, unless scratching litter is provided and regularly turned over daily, when fresh grain is thrown into it. Sufficient mineral ash must be present in the ration, abundant green food, and a clean, open-front house. Natural or artificial shade is also a great factor for success. In short, the birds must be comfortable. It is sometimes thought that if the birds are fed regularly and kept clean, the poultryman is entitled to expect the birds to do the rest. But this is not necessarily the result unless in addition the comfort of the birds is very closely studied. The provision of comfortable nests is probably a not unimportant factor in producing high egg yields. It is of course impossible to say what influence discomfort in any form has upon production, but it is probably much greater than is often supposed, since the hen is a highly sensitive organism. We know that, as a rule, changes of diet or of location will have an immediate and quite unmistakable effect upon production, and minor discomforts probably produce real loss of efficiency, although we may not be able with certainty to trace their effects. If this is so, we must study the habits of the birds in the smallest detail, if we wish large production. Restless or listless birds are a sure sign that something is wrong.

Let us suppose that our breeding stock is in high fettle, singing away in the litter or dozing contentedly in the shade after an early morning passed in the litter, followed by a good breakfast. We are sure that the eggs are of high hatching value, since we put twelve under an old hen three weeks

before, and she hatched the lot. We are now ready to start out to emulate her example and get a big hatch. I have found that in this climate the eggs should not be more than three days old, when put into the incubator, if the best results are to be obtained. The usual rules should be observed, of course, as to selection of regularly shaped eggs, not too large nor too small, and with good shells free from the mottled appearance, which is easily seen by holding the egg before a candle in a dark room.

The machine has, we will suppose, been running for a week empty, so as to get thoroughly heated and dried throughout. We have an even temperature of 102 deg. in the machine when we set the eggs.

The main problem, as I believe, is still to be considered, namely, the question of location.

If we watch the old hen on the nest, we find free air all round her, which is slowly passing over the eggs also, retarded in its passage by her feathers and warmed by her body. But there is a constant current of air passing over the eggs, although slowly, since the heat of her body must draw the air inward toward her. I am not an expert in ventilation, but I assume it to be true that if the inside of a room is warmer than the outside air, and we then open a window, there is a rush of the colder air into the room—we create a forced draught. Apparently the hen does the same, the heat of her body acting like the heated room upon the colder outside air, when we open the window. If this analogy is correct, we get an idea to work upon, namely, that we want free currents of pure air, constantly but slowly passing over the eggs. No easy matter, as we have first to get the pure air to flow into the incubator-room and then into the machine. The problem as regards the machine is simplified since we have the heat of the lamp to correspond to the heat of the hen's body and draw the colder surrounding air. At night when the outside air is colder than that inside the incubator-room, we can easily get pure air by means of ventilators. But in California the temperature by day outside the room is often as great as that inside the room, and if the sun plays upon the incubator-house, the temperature inside the latter may be even slightly greater than that outside. In this case, the difference of temperature of the inside of the room and that of the outside air would not be great enough to cause a current of air to flow; the air in the room becomes stagnant, the exhausted air from the lamp and the eggs will not be replaced, and the embryos in the machine are poisoned. Again the incubator-room may become so warm that it is found impossible to keep the temperature of the machine at 102 deg. even after putting out the lamp, and the embryos are thus not merely poisoned by stagnant and exhausted air, but debilitated by too much heat, while the time and temper of the poultryman are wasted if not exhausted in constant visits to the machine to study the thermometer.

How are we to keep the room cool, and, moreover, cooler than the outside air?

I have found that insulation of the roof and walls of the incubator-house is the only solution of the problem.

I build a frame in the usual way, nail boards outside the frame, then tack brown paper inside the boards. I put more boards horizontally inside the frame and put brown paper again inside these. This can be done by nailing, say, two boards at the bottom of the inside wall, and then slip brown paper inside them down to the floor level. Sawdust is then poured into the space between the boards and tamped down with a stick. The sawdust holds the brown paper firmly against the inside and outside boards. If the frame is made of 2-inch by 4-inch lumber, we can thus get four inches of sawdust between the boards which are nailed to the 2-inch-wide faces of the 2x4's. The process is then repeated by nailing two boards at a time until we get to the top of the frame. The same method of insulating is followed with the roof. Boards are nailed to the under side of the rafters. Brown paper is put on the upper side of these boards and then sawdust filled in level with the upper side of the rafters, over which again another layer of boards is placed with corrugated iron or roofing paper over all. The door should be insulated in the same way.

The height of the walls of the incubator-house should be ten feet. There should be one or more windows placed lengthways, say two feet long by one foot wide, and hinged at the bottom, on each wall of the house placed immediately under the eaves. On still days, all these windows should be kept open by day and the door also, so that the machine practically stands in the open air. If the wind blows fresh and there is too much draught, the window on that side of the house facing the wind should be closed. As the windows are hinged at the bottom, it is possible to get plenty of air without direct draught upon the machines by leaving these windows open half an inch, or less, even. The air will flow in round the sides and top of the window, i.e., upward or across the room, but not downward on to the machines. If opposite windows are left open, there will be a good overhead cross-current of pure air.

To insure the same cross-currents below, one or more ventilators always open, are placed in each wall on the floor level. This will cause a good cross-current too far below the machine to affect the lamp.

By this means I have found that the air in the incubator-room is always fresh and

the SMELL OF THE LAMP CANNOT BE DETECTED. Where there is a smell of lamps there is insufficient ventilation.

At night the windows are closed, the fresh air coming in through the permanently open ventilators.

The walls and roof do not get hot, and the room will remain at a lower temperature than 93 deg. when that outside is over 100 deg. This enables the incubators to be operated and if a machine fitted with a sleeve on the wick attached to the regulator is used, there will be no trouble in maintaining an even temperature, in any weather likely to be experienced up to the first of June, or even later.

This method insures plenty of fresh-air currents passing through the machine and has this great advantage. First, it does away with the necessity of cooling the eggs. Simply turn the eggs and put them straight back into the machine. They get all the fresh air they need, and cooling is unnecessary and undesirable. For the beginner, and even for the experienced operator, this is a great advantage.

Second, the moisture question is also solved. Since currents of pure air passing constantly over the eggs will dry them out, we may use moisture in the moisture trays from beginning to end of the hatch. If just before the eggs pip it is thought desirable, boiling water may be put into the trays to rapidly produce additional moisture.

As near as we can, we have imitated the free-air and free-moisture method of the hen.

By this procedure I have always secured large hatches in California, South Africa and elsewhere, and the quality of the chicks produced is something to be seen before it is believed.

They are products of pure air moistened and heated before it passes over them when in the shell, and pure air moreover which is constantly renewed throughout the hatch. I should perhaps mention that I run the machine at 102 deg. for the first week, 102½ deg. for the second week, 103 to 103½ for the third week.

CHAPTER VI.

CHICK FEEDING.

Let us suppose that we have, to our great satisfaction, secured a big hatch of chicks—strong, lusty little fellows, eager to get out and try conclusions with the world. How soon shall we feed them after hatching and where shall we put them? I saw that some expert in an address given, I think to the American Poultry Association, advocated feeding chicks as soon as possible after they had hatched. This doctrine was new and rather startling to me, and my first feeling was to reject it altogether; but it is necessary to keep an open mind on matters connected with poultry raising. The views firmly and even universally held today may be discarded tomorrow and we are always learning.

Pending further experience, I am doubtful as to the wisdom of feeding chicks immediately after hatching, simply because the hen does not appear to do so. Again and again I have observed that a hen will sit close on her newly-hatched brood for twenty-four hours, so that it is impossible to say how many chicks she has hatched, until she brings them off or is removed to a coop. Again and again twenty-four hours after the date on which the chicks were due, I have seen a hen sitting hard and no sign of a chick to be seen. On raising her to take her to her new quarters, I have found that she has twelve or thirteen chicks—a 100 per cent. hatch—under her, all fast asleep in the bottom of the nest. I generally remove a hen at night to her new coop, so that the chicks may get at least another twelve hours' sleep before daybreak. This gives thirty-six or even forty-eight hours before the chicks are fed, and they are certainly never the worse for the quiet hours after the struggle of hatching. As a rule the hen will call them from under her, if breakfast is given in the morning, but they eat very little and soon go back to sleep again for a few hours under her wings. From the practice of the hen, there does not seem to be any justification for feeding chicks immediately after hatching, and I should not depart from my rule of not feeding for thirty-six hours or more without strong evidence that this is desirable.

I put a match between the door of the incubator and the frame to admit abundant fresh air, and hang sacks over the glass or, better, paste paper over it, to darken the interior, following what seems to me to be the practice of the hen. It appears to be a convenient rule to remove the chicks from the incubator late in the afternoon, so that they only have time for one good meal before dark. If they are put into the brooder earlier in the day, the poultryman has to watch them all day, as they will not go under the hover readily, and may get chilled. I have found that after one night under the hover—provided always that this is warm enough—the chicks require no further schooling, but will always run to the heat when they require it.

Much, very much, depends upon the impression left upon the chick's mind of the brooder hover during the first night. If this is warm and comfortable, the favorable impression is apparently never forgotten, but if the hover is too cold and the chicks crowd, the results are disastrous. The habit of crowding once acquired is probably never lost, even if the heat is subsequently increased, and the discomfort of the first night under the hover is never forgotten. The result is that the chicks do not return

readily to the hover when cold, because they do not associate that spot with the ideas of warmth and comfort. Many will therefore get chilled and die, even if the lack of warmth is remedied after the first night.

The brooder should be thoroughly heated some days before the chicks are put in and its variations noted during the night. How many disasters we should have averted if we had noticed that the heat fell ten degrees during the small hours of the morning—the day before we put the chicks in, rather than the day after.

To minimize the variation of temperature during the night, I insulate my brooder-house with sawdust, in the same way as the incubator-house, described in the last chapter. If the runs are five feet wide, I put in a window to each run, four feet six inches wide, so that I get the maximum amount of light possible into the house, which should face directly east or northeast. I duplicate these windows in the west side of the house, so that the latter is flooded with light all day. The advantage of this method is that on hot, still days I can open the windows on both sides of the house and get a through draught over the heads of the chicks, which will be fast asleep in the straw below. The roof and walls being insulated, will never get hot and the temperature of the house being lower than that of the air outside, there will be a good draught if the windows are opened on both sides.

Again, lice, like another and higher class of animal, "love darkness rather than light," and if the house is lighted, as suggested, these objectionable creatures will not have so agreeable a resting place, as is frequently the case.

I have not yet considered the question of feeding, because under the system which I advocate, this largely depends for its success upon the construction of the brooder-house.

I felt for a long time that the practice of feeding chicks five times a day by hand was crude and objectionable for two reasons. First, because of the immense labor involved, and secondly, because the results were most unsatisfactory. The chicks did not develop normally. There was an uncanny growth of wing in my Leghorns, with the result that the chicks could not support the weight, and went about with their wings trailing on the ground.

The Cyphers Incubator Company sent me a pamphlet advocating the "scratch to live" method. They said that the trailing-wing phenomenon was due to lack of normal development of other parts of the body. The chick devoured the meals provided five times a day without any effort being required by the leg muscles to get a full crop, with the result that the growth went into feathers instead of leg and other muscles. I felt sure they were right and adopted their method, with the most satisfactory results.

I lowered the floor of the inside of the house two feet six inches away from the hover to a depth of eight inches. By leaving this space between the hover and the lower level of the floor, I had room to put the drinking water and the oyster shell and charcoal boxes, on the same level as the hover on a solid floor. I filled up the sunken floor to the level of the hover floor with litter, i.e., eight inches of litter; disposed as follows: Two inches of litter, then a layer of chick feed, then two inches of litter and another layer of chick feed until I had four layers of chick feed and four layers of litter, the latter each two inches deep. The pamphlet stated that sixty pounds of chick feed, disposed in this way in four layers of litter would feed fifty chicks for six weeks.

Having made these arrangements, I put the chicks into the brooder-house. The first day I fed by hand three meals of stale bread crumbs, moistened with milk and the artificial ash liberally sprinkled upon them. The second day I left the chicks to scratch out their own living; giving them a little bran and corn meal with the artificial ash mixed dry and then slightly damped with milk (or water,) the last thing at night. I put a hopper of beef scrap into the run so that the chicks could help themselves at will.

The chicks were let out in the morning of the day following their first night in the brooder-house. I built a scratching shed, with eight inches of litter as described in the pamphlet outside the brooder-house, by making a frame three feet wide and twenty feet long (the length of the brooder-house,) and covering it with water-proof canvas. This frame rested on a ledge below the windows made by nailing a two-by-two strip to the wall of the brooder-house and a similar strip three feet away nailed to the uprights of the runs, which were sunk in holes dug three feet from the brooder-house wall.

The runs were sown to alfalfa and were seventy-five feet long and five feet wide (the width of the run inside the brooder-house.)

By these arrangements the chicks could scratch in the shade inside the house or outside. They could sleep under the hover or in the straw inside the house, or outside in the scratching shed or in the sunshine of the open run.

Water was supplied by means of a drip cock attached to a small stand pipe, and with a cup below. I could thus leave the chicks to their own devices all day, having to feed them only once a day as the sun went down. The heat was provided by gas jets, one to each hover. The results in the quality of the chicks raised, and the labor saved were most satisfactory, and 5000 chicks could probably be managed by one man in this way.

The chicks raised under hens were fed on the same principles. An inclosure was built, with a scratching shed inside and coops all round it. The hens with their broods returned every night to get the bran and corn meal with the artificial ash, when the door of the inclosure was closed for the night.

Each hen went to her own coop and started scratching in the litter in the morning until I came round and opened the door of the inclosure. As soon as this was done, the hens and their chicks went away for the day, returning at nightfall for supper.

CHAPTER VII.

POULTRY FARM SITES.

This chapter will try to deal with the selection of a site for a poultry farm and of the poultry buildings on that farm. It assumes that a considerable acreage is to be or has been acquired, so that there is a choice of several sites for the poultry buildings.

The chief factors in selecting a poultry farm would appear to be freedom from damp, i.e., ground which is either naturally well drained or where it can be made so by artificial means. Secondly, accessibility to markets; thirdly, a good and abundant water supply; fourthly, soils suitable for alfalfa; and fifth, the actual poultry buildings on level ground to economize labor.

I have put the question of a dry site first, because in Southern California this is the only danger to be guarded against when considering climatic conditions. In this part of the country, cold is a negligable factor. A good sharp frost will not hurt fowls, although if continued night after night, the egg yield might suffer, if the birds were not kept in a warm house. The health of the bird would not be affected, but the exposure would divert surplus energy from the production of eggs to the manufacture of more vital heat to keep the body warm.

A curious case came to my notice where the conditions were such that proof was forthcoming that the surplus energy of five hens in a poultry-house was actually diverted from egg production in this way. All the conditions for egg production were favorable, but the hens would not lay an egg. I found that the house was roofed with corrugated iron which draws the cold, and at 10 o'clock at night the backs of the hens, under the roof, were white with frost. A ceiling of matched boards was put in about four inches below the corrugated iron, when egg production began at once and the birds laid heavily. The non-production of eggs does not necessarily imply ill health on the part of the birds, but that either the surplus energy is diverted from egg production, or that it is not the result of feeding adapted for the production of eggs, in which case it may be stored as fat in the body, if not required to combat cold, or again there may be no surplus energy, owing to insufficient nutrition. It is quite possible to give a maintenance ration to hens, which will support them in good health, but which will not admit of any surplus for egg production.

The frosts in Southern California are not sufficiently severe, nor continuous to make them a factor to be considered.

Shade from the heat is a more important question which must be considered and provided either by natural or artificial means, but the real enemy is damp of long continuance after wet weather. If the fowl-house is damp for any length of time, owing to the site being deficient of drainage, egg production will cease entirely.

I had a few hens about 500 yards from a large sheet of water lying in a shallow pan-shaped depression. The fowl-house was about fifteen feet above the water, but the mist rose every night from the "pan" and the birds would not lay an egg. I removed them about thirty feet higher up and 500 yards further away from the water and egg production began at once. This is only one of many instances which have been brought to my notice of the deadly effect of damp in the fowl-house, on the egg yield.

It sometimes happens that the only site available is at the bottom of a hill. If the hill is high and steep, it may be found impossible even by drainage to keep the land at the foot dry owing to the seepage from the hill above continuing for weeks after wet weather, or there may be underground springs in the hillside. In this case poultry raising will never be possible, since during the rainy season when eggs are high in price, no eggs will be obtained from the pullets. I reported upon a site of this kind in Northern California, where the poultry buildings were surrounded on two sides by lofty and precipitous hills, with the result that the poultry-houses wreaked with damp during six months of the year. Practically no eggs had ever been obtained after the beginning of the rainy season, until the following March or April, and the business was a dead loss.

Curiously enough on the same farm not 1000 yards away was the most ideal site for a large poultry farm which I have ever seen, and a description of which will illustrate, I think, the question of a good site.

There was a flat-topped low hill running for over a mile on the west side of a valley. The hill was probably 100 feet above the valley. From the rim of the flat top the ground fell away steeply for a hundred yards, and then sloped gently to the bottom of the valley. The whole of this slope was under alfalfa, of which there was forty acres along the hillside. The soil on the steepest part of the hill and on the flat top

was shallow but deep enough to grow crops of oats and barley. The flat top was 200 yards wide. I designed a row of poultry-houses on each rim of the flat top, with runs running down into the alfalfa, and alternating runs 100 yards wide behind the houses on the flat top, with motor car road running midway between the houses—thus having the alternating runs on both sides of this road.

The water supply came direct from a reservoir 1200 feet away across a ravine, and about fifty feet above the flat-topped hill.

The owner objected that the top of the hill would be cold. I asked him why his sheep always slept on the top of the hill and not on the sides or bottom. He admitted that they did so, but that the reason had never occurred to him. In South Africa and California it is always much warmer at night on the top of a hill than it is on the sides or bottom. The Dutch have occupied South Africa for several hundred years and you will always find their houses on high ground. So again on hot summer nights, it is cooler on the top of the hill than it is at the sides and bottom. Campaigning in South Africa taught me the truth of this, and I always slept on the hilltop if I could. I noticed that the wild birds always had their nests on the hilltops and the deer will be found in such places at daybreak, more frequently than in the bottoms.

On the other hand, fowls love to run in the wet bottoms in the daytime, where the grass is greenest and animal life abundant. This is ideal for them, provided that they are not kept there at nights, but can return to the high ground to roost.

From the foregoing I think it will be clear that we must in selecting a poultry farm, give our chief consideration to the question of drainage. Where a site at the bottom of a hill is forced upon us, an elaborate system of drainage must be installed to carry off the storm water and prevent it from coming down into the bottom where the poultry is. Deep drains cut across the face of the hill to bring the water from above into a conduit running through the ground below will be essential.

Referring again to our flat-topped hill, we have an ilustration of the advantage of having all the poultry buildings on level ground. The ground on our flat-topped hill was as level "as a billiard board," and every part of the plant could be reached from the feed house on hard level ground by a wheelbarrow. The rock underlying the layer of soil kept the ground hard and firm after heavy rains. It is a serious drawback to have to feed poultry from a wheelbarrow pushed or dragged through marshy ground, and where this is liable to occur a pathway of boards or asphalt becomes a necessity, between the feed house and the poultry runs.

The question of a market is one of which the importance is evident and must be carefully considered in relation to every site contemplated as generally suitable in other respects.

Alfalfa is almost a necessity of life on the modern poultry farm, since the success or failure of a poultry business is mainly determined by the amount of labor required to operate it. To have to grow other green food for the fowls means a very serious addition to the labor bill, since the ground must first be prepared, then the kale or other green stuff sown, kept free from weeds and watered regularly. It has then to be gathered, cut up and fed to the poultry.

If alfalfa is firmly established in the runs, the fowls cannot root it up or eat it off, provided that the proportion of poultry to the acreage of alfalfa is not too large. Again, the alfalfa is practically growing all the year here and absorbs the droppings of the poultry quickly so that the ground does not become foul. It is needless to dwell upon the advantage to the birds of unlimited green food at any time of the day.

The writer believes that the alfalfa lands of California will ultimately ensure that a great industry will be established here and that the economic advantage which, with the sunlight, they give to our poultrymen, will enable the latter in the long run to compete successfully with the East and export their eggs and poultry by the million dollars' worth to States which have not our climatic advantages.

CHAPTER VIII.

POULTRY BUILDINGS.

It is here assumed that the open-front house for poultry is now generally accepted as the type of house which has replaced all previous types and is destined to be universally used, except in countries where the temperature falls below zero daily for months together during the winter.

In many parts of Northern California there are sharp frosts every night for several weeks during the winter, and a house hermetically closed on the back and sides and open in front is necessary to prevent the surplus energy of the poultry being diverted from egg producton to the manufacture of heat to combat the cold.

In some sections of the country, notably in the mountains, the cold is very severe at nights, and egg production is seriously affected. In these districts, the open-front house may be made warmer without sacrificing the open front by using the box roost. This consists in putting droppings boards about six inches under the perches which should all be on the same level.

These droppings boards may be made of half-inch thick lumber in sections about four feet square, which can easily be pulled out through a slot cut in the back of the house. These sections of droppings boards rest on slides fixed under the perches. Thus if the house is twelve feet wide, three sections of droppings board will be required, which will rest when in position on a piece of 2-inch by 2-inch lumber nailed horizontally to the back wall six inches below the perches and a similar piece of 2x2-inch lumber reaching from side to side of the house four feet from the back wall. The slot cut in the back of the house should be six inches wide to enable the sections of droppings board to be easily pulled out and the droppings scraped off into the wheelbarrow. The slot must be kept closed by a closely fitting door hinged from the top and secured by a button on the wall below. Over the perches, similar half-inch boards rest on slides, to form a roof three feet above the perches at the back and two feet six inches at the front. This roof forms the top and the droppings boards below the perches the bottom of the box roost, while the back and sides of the house form the back and sides of the box. This box roost still has the open front, but the heat generated by the birds instead of escaping immediately to the roof of the house, is retarded by the box roof three feet overhead, so that the temperature in the box roost is materially increased. Again, the birds have two roofs over their heads, viz., the box roost roof and the roof of the house, which further increases the warmth of the birds.

In Southern California, I do not think that the open-front house hermetically sealed on the back and sides, is necessary. We can dispense with the back and sides altogether, retaining only the roof to keep the sun and rain off. I have recently designed and built for a client near Los Angeles, buildings of this kind to hold 400 birds. The dimensions are 45 feet long by 24 feet wide. The ridge may be 9 feet high and the open sides 5 feet high. These are boarded up at the bottom 3 feet to keep in the litter and provide cover for the birds from the sun and wind. A row of uprights are placed 4 feet from the sides of the house. These uprights are 3 feet apart and reach to the roof, forming an aisle on each side of the house 4 feet wide. A bar running the whole length of the house is fastened to these uprights 4 feet from the ground. On this bar, rest one end of the droppings boards, the other end of which rests on another bar fastened one-half an inch below the top of the boards forming the sides of the house. As these latter are 3 feet high only, the droppings boards will have a slope from the top of 1 foot in 4 feet—the width of the aisle. Bars are fastened horizontally across the aisle just above the upper end of the droppings board at intervals of 9 feet. The perches running the whole length of the house rest in slots in the cross bars. The birds therefore sleep in the open air nearly one foot under the roof, the eaves of which should project about one foot over the side of the house. All bars carrying roosts or droppings boards are removable, as they rest in cheap iron holders, as shown in sketch (Fig. 1). The perches rest in slots made of small pieces of iron bent to a right angle and screwed into the bar (Fig. 2). The bar should be tarred before these slots are screwed on.

The nest's boxes are arranged on each side of the uprights which carry the ridge pole. The detail of the nests is shown in Fig. 3 and their position in Fig. 4 (Section). Fig. 5 shows the elevation of the house.

If desired, the floor of the shed may be divided into five compartments by putting a board 1x12 inch on edge across the house every nine feet. This makes it easier to renew the litter, as the whole floor space need not then be renewed at one time.

If we build the house 45x24 feet we get nearly 1100 square feet of litter for 400 birds, or 2¾ square feet of litter to each hen.

Experience shows that on hot days, the birds will sleep under the droppings boards at the side of the house. These droppings boards with the roof of the house, form two roofs over the birds in the straw beneath, and the latter evidently find this part of the house is the coolest.

The nest boxes are also provided with a roof and a partially open back to allow plenty of air on hot days.

During the great storm of rain with the wind blowing a gale, which occurred in Los Angeles in February of this year, the birds remained dry and healthy in these sheds which I have been describing and no sickness of any kind occurred. A more severe test of the shed house open on all sides is not likely to occur in Southern California, and I venture to believe that this class of building is destined to be largely used in this part of the State.

The droppings boards are simply laid side by side across the aisle, and are not fastened down. They can thus be easily removed for cleaning. To further facilitate this, the boards are made of ½-inch lumber (redwood) and are very light. Troughs wide enough to admit a spade are fixed as shown in Fig. 4, so that the droppings roll off the boards into them. The poultryman with a spade and barrow can quickly remove the contents of the troughs, there being a free passage all round the house.

Figure 5 shows the section of a house closed on two sides and the back, suitable for the colder sections of the State. The nest boxes are outside and box roosts are fitted together with a slot at the back of the house so that the droppings boards can be pulled out at the back. This is a great advantage, as the droppings can then be dumped direct into the barrow or wagon and the necessity of going into the house to clean the boards is avoided.

Sections of a brooder-house and incubator-house, both insulated with sawdust, are given in Figures 6a and 7.

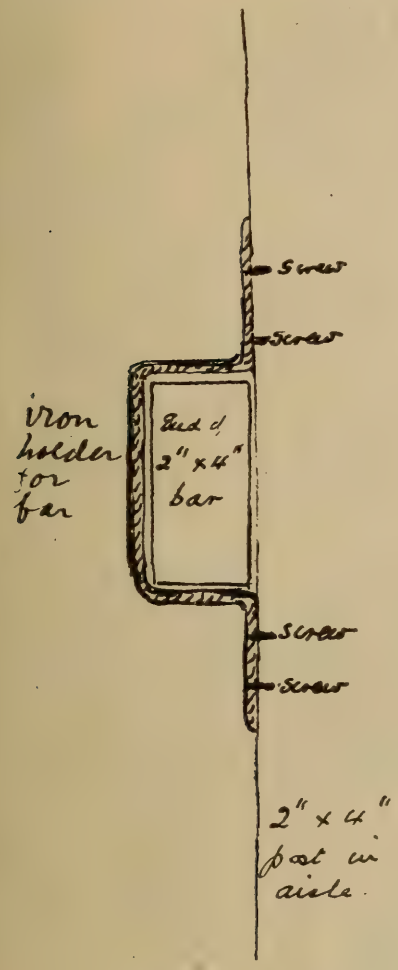


Fig. 1.

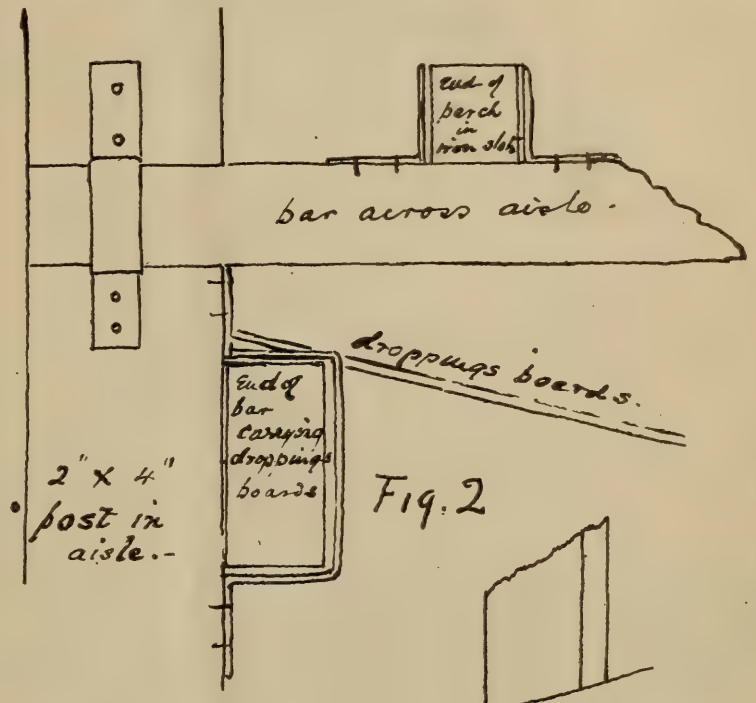


Fig. 2

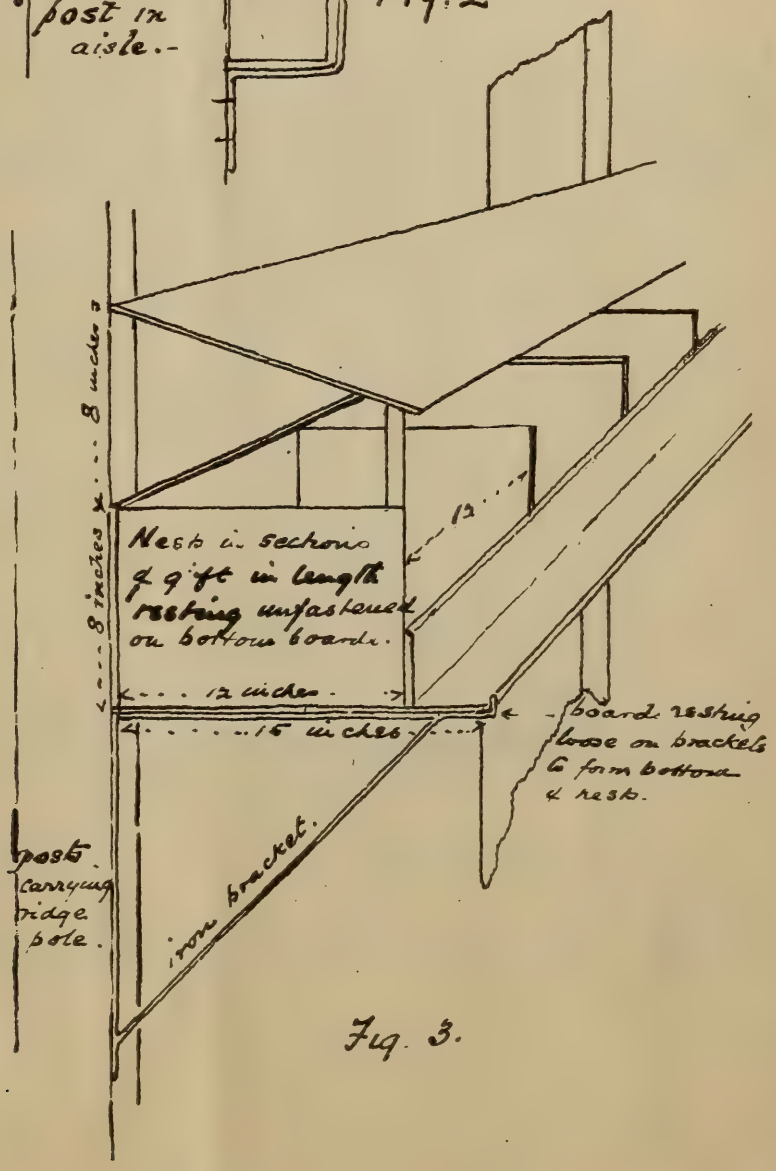
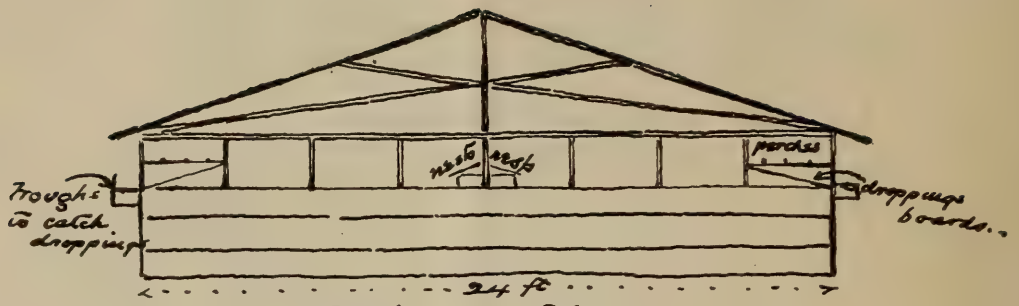
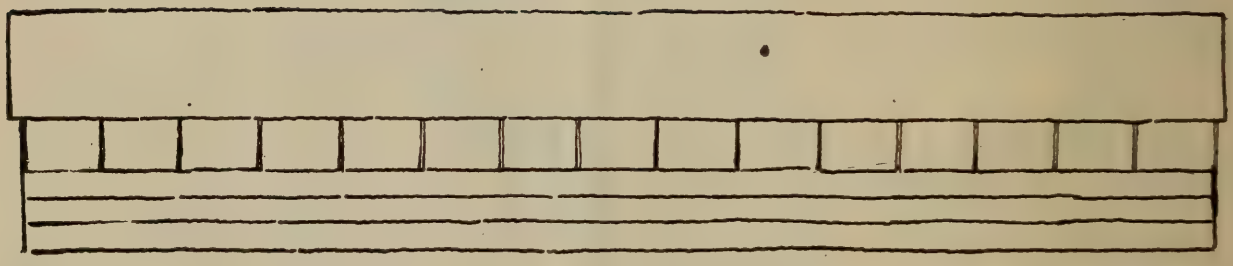


Fig. 3.



Section of Shed.

Fig 4.



Elevation of Shed: perches & droppings boards not shewn

Fig 5.—

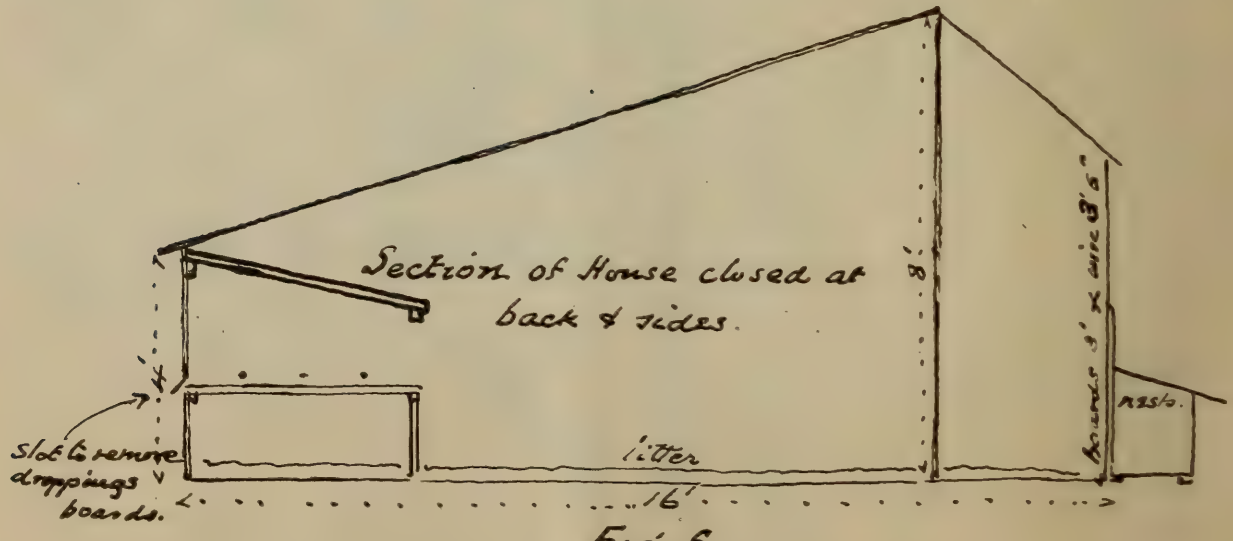
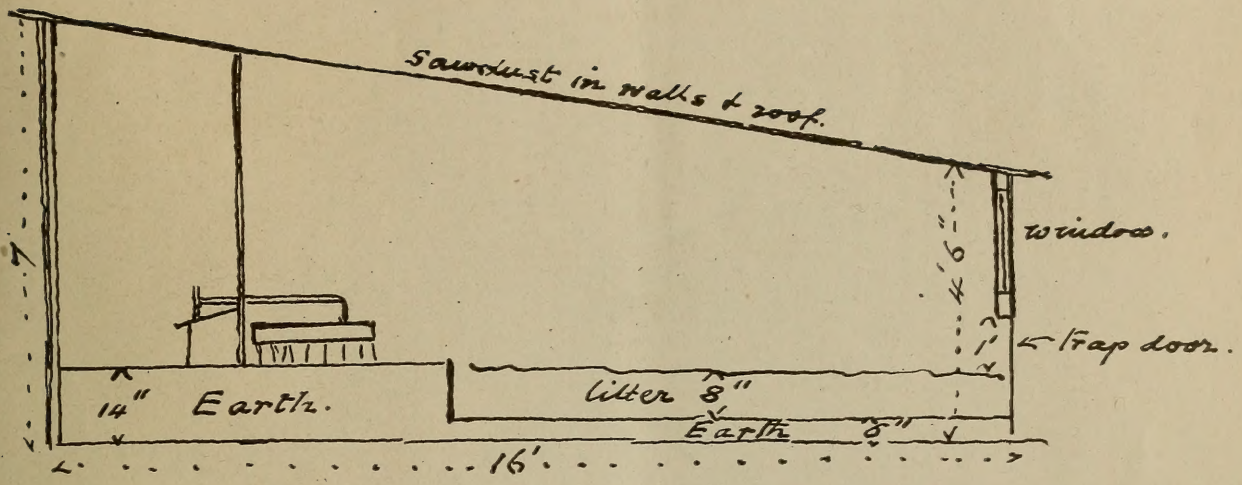
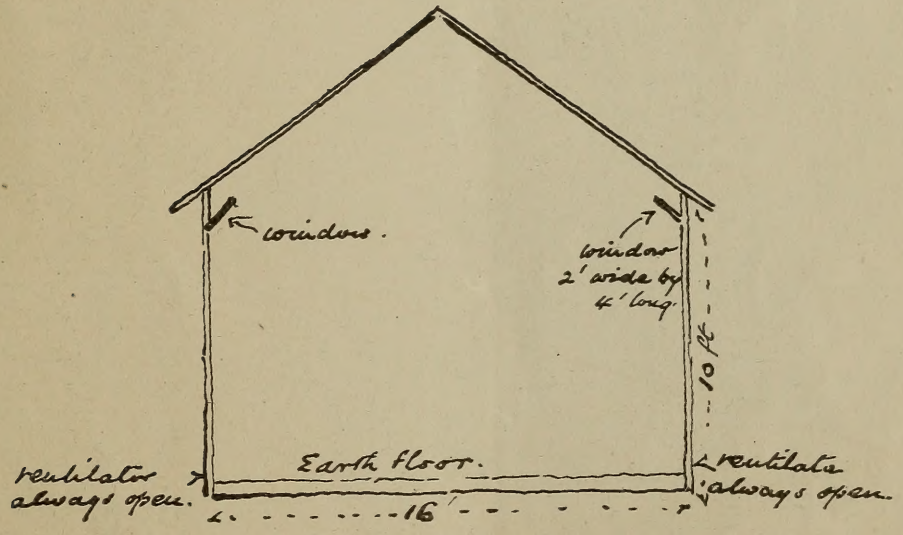


Fig 6.—



Section of Brooder House.

Fig 6.-

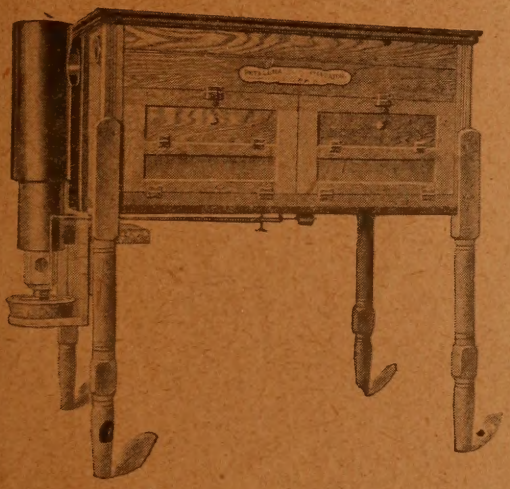


Section of Incubator House.

Sawdust in roof & walls.

Fig 7.-

Petaluma, California



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